



Universidade do Minho
Escola de Engenharia



CENTRO DE CIÊNCIA E
TECNOLOGIA TÊXTIL



citeve
TEXTILE TECHNOLOGY

DISTINCT ANTIMICROBIAL ANALYSIS TO EVALUATE MULTI-COMPONENT WOUND DRESSING PERFORMANCE

Jorge Padrão, Inês Pinheiro, Carla Silva, Alice Ribeiro, Verónica Bouça, Liliana Melro,
Rui D. V. Fernandes, Ana I. Ribeiro, Helena P. Felgueiras, Andrea Zille



20th World Textile
Conference

Unfolding
the Future

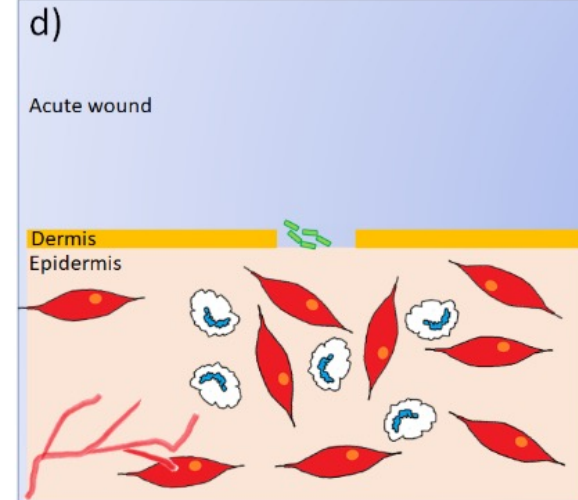
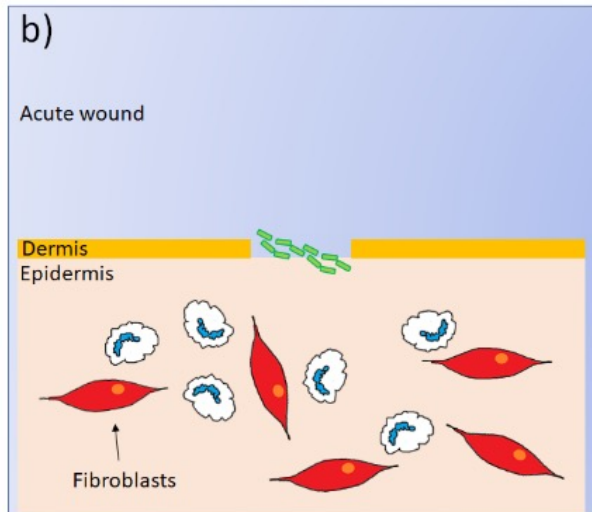
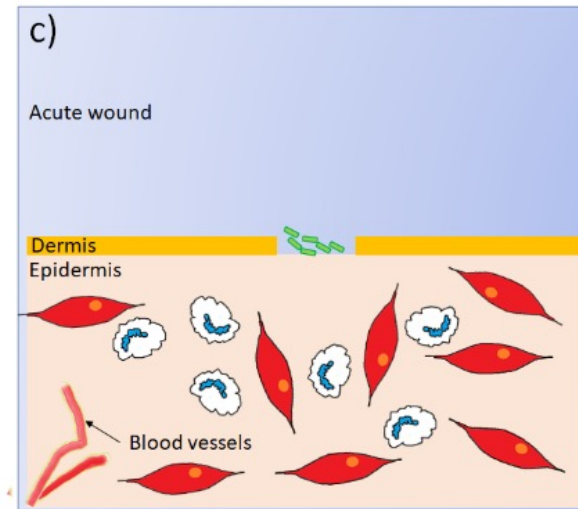
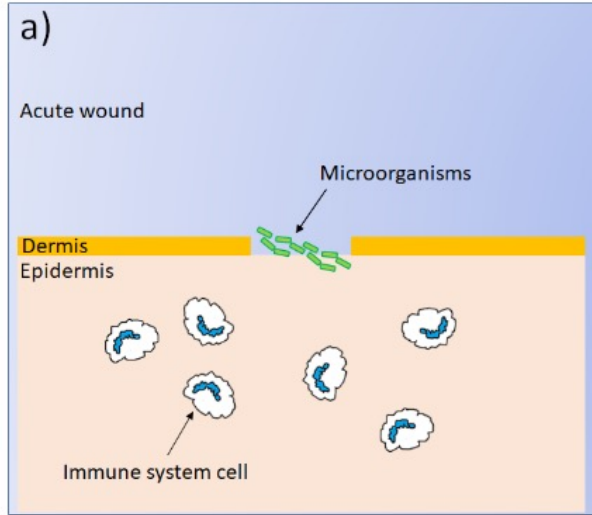
Wounds

Wounds may caused by:

- Trauma
- Cuts
- Surgery
- Burns
- Incisions
- Abrasions
- Lacerations
- Punctures
- Chemicals



Wound healing



Wound dressing

Ideal wound dressing:

- Sterile
- Provide adequate gas exchange
- Maintain ideal level of moisture
- Biocompatible
- Microorganism barrier
- Eliminate excess of exudate
- Enhance wound healing process
- Prevent surface necrosis
- Odour control
- Elastic
- Easily removed



<https://monadnockcommunityhospital.com/services/surgical-services/wound-healing-center/>



Song X, Melro L, Padrão J, Ribeiro AI, He Z, Yu L, Zille A, Nonwoven materials and technologies for medical applications, *in press*

Wound dressing composite

Lint



Shutterstock



Animal
grease



<https://www.dreamstime.com/photos-images/tallow-grease.html>



Honey



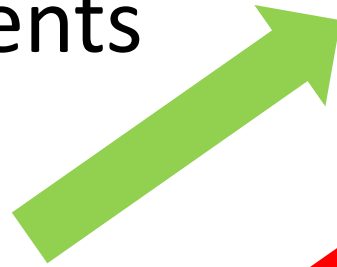
<https://booktrib.com/2020/12/09/pharaohs-gods-and-kingdoms-9-tales-from-ancient-egypt/>

<https://hornsby-beekeeping.com/honey/>

Antimicrobial agents

Dose dependent activity

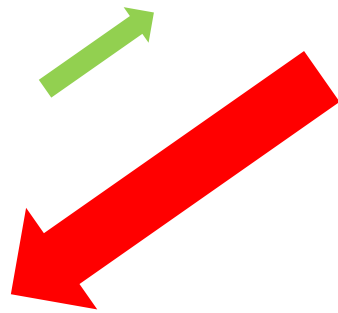
Antimicrobial agents
concentration



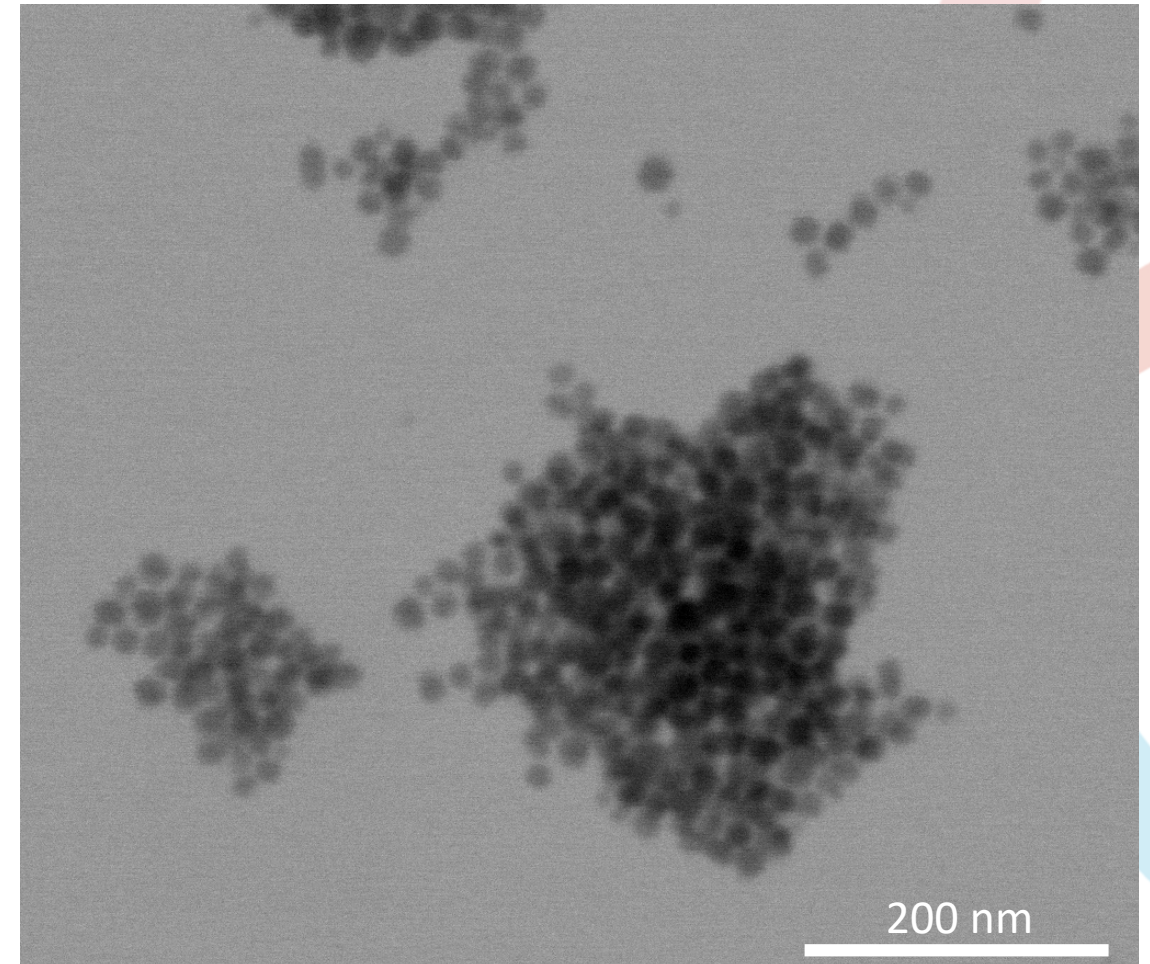
Microbial viability & resistance

Nanoparticles

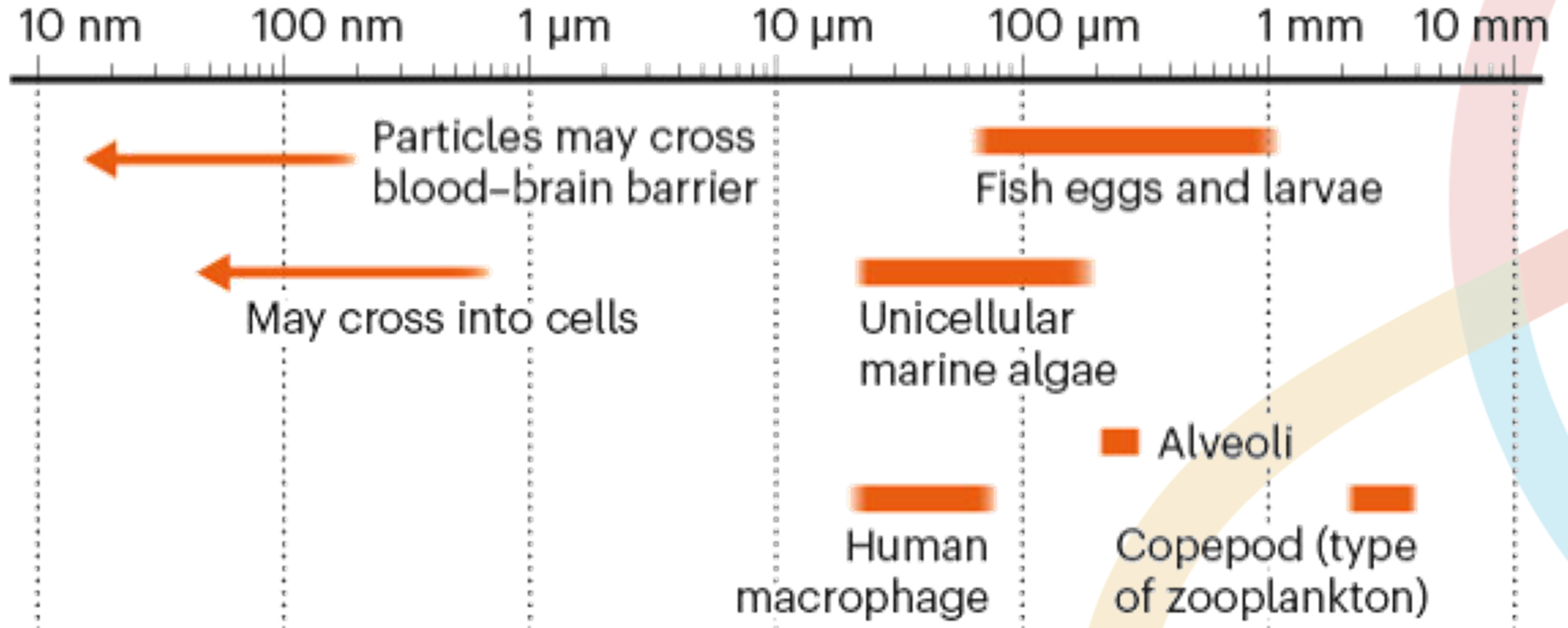
Antimicrobial agents
concentration



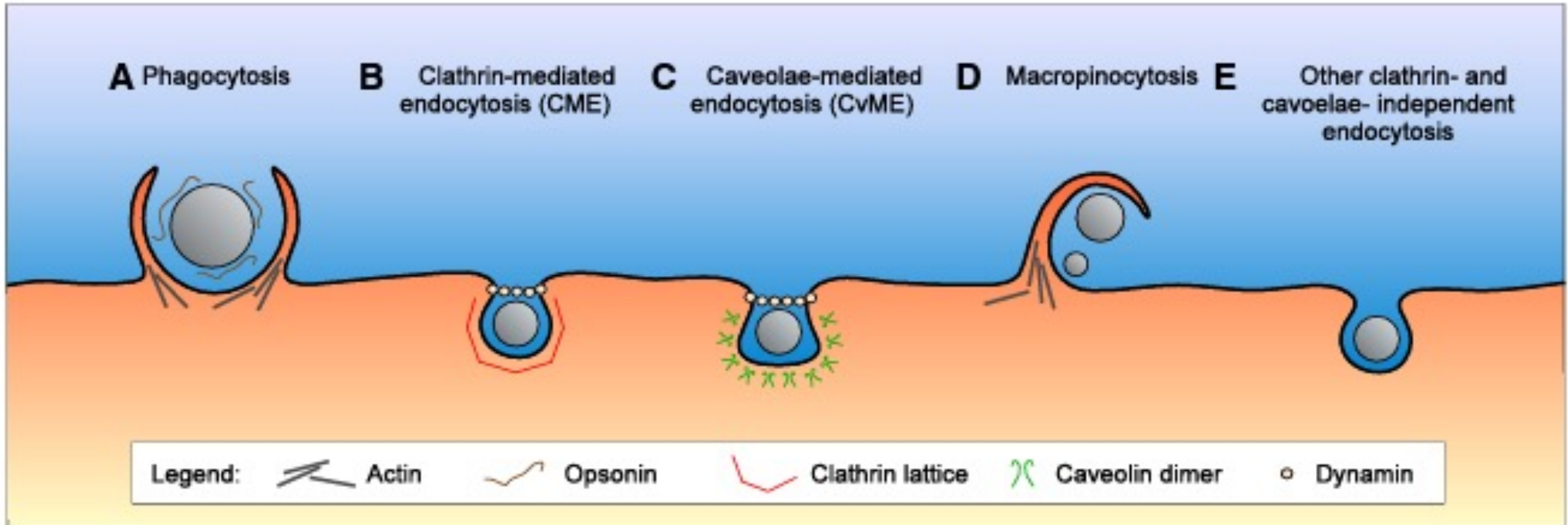
Microbial
viability &
resistance



Nanoparticles size



Cells uptake



Cells uptake

200 nm



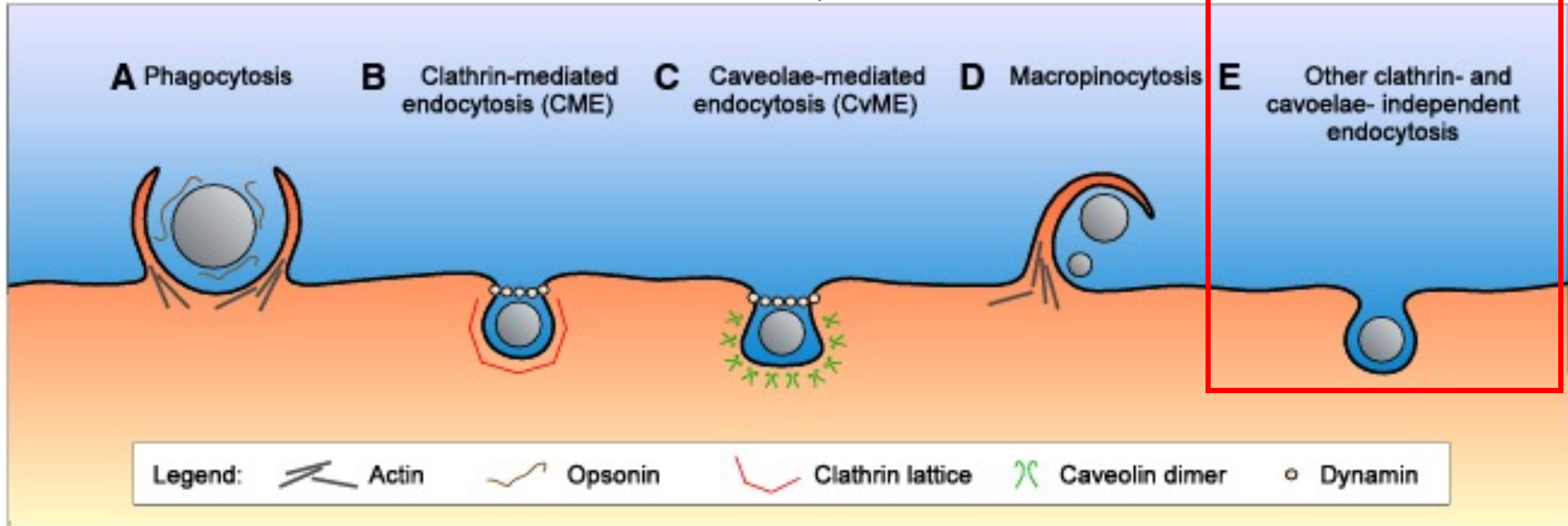
> 200 - 500 nm



1 - 5 μ m



< 25 nm



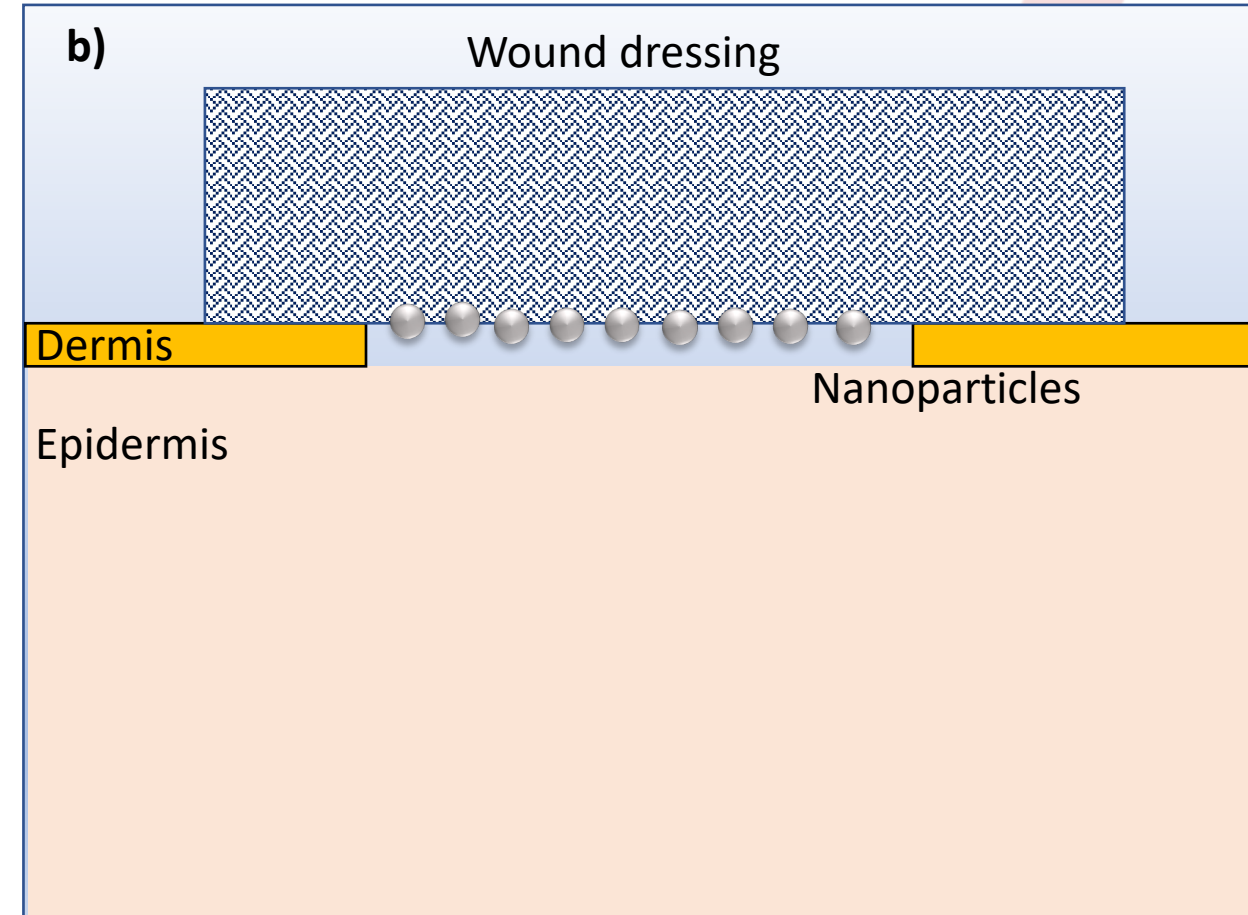
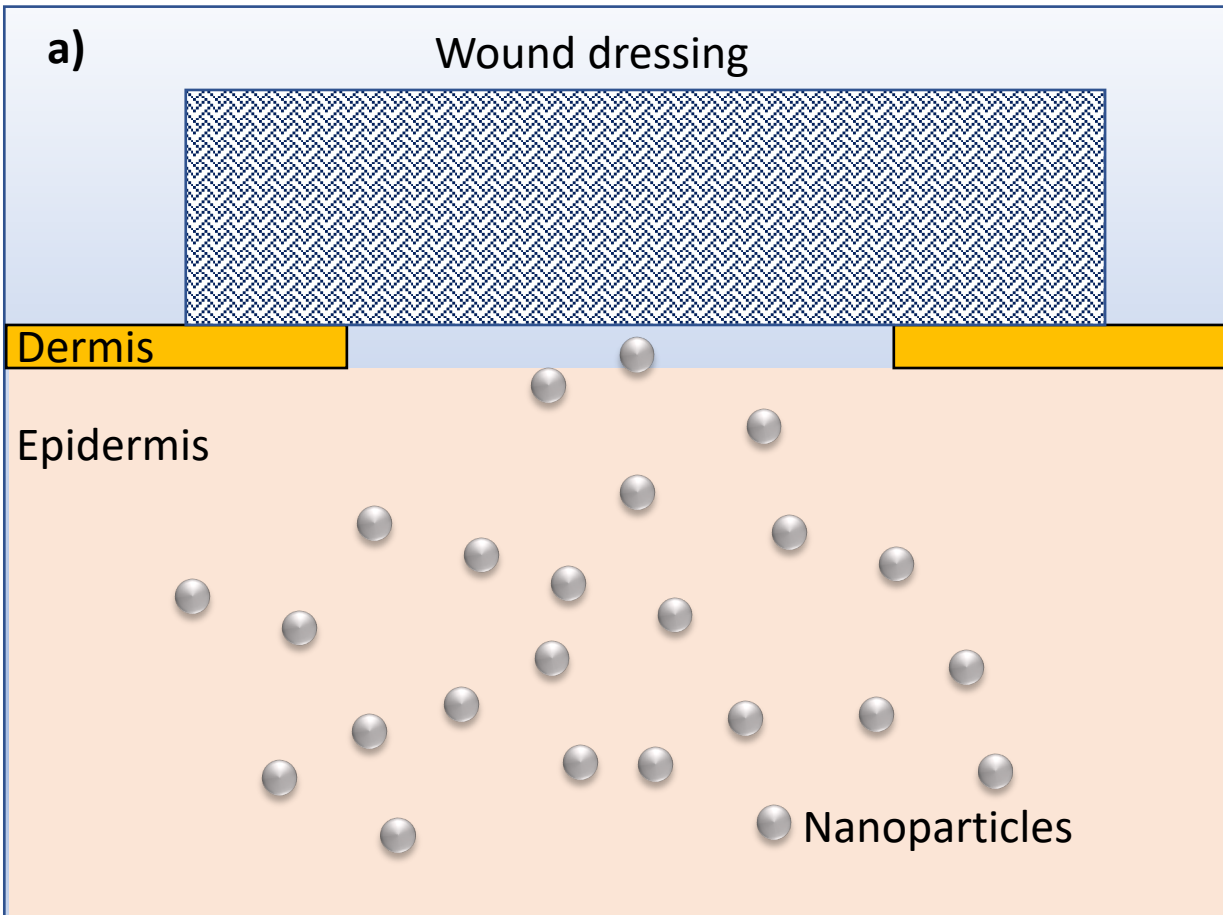
Size is not everything

Factors influencing uptake:

- Receptors
- Charge
- Hydrogen bonding potential
- Lipophilicity
- ...

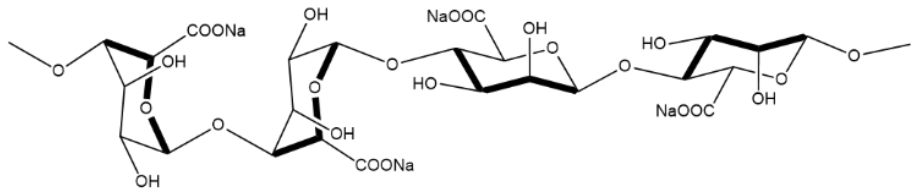


Choose freedom?

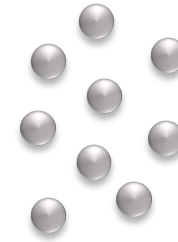


Multi-component wound dressing

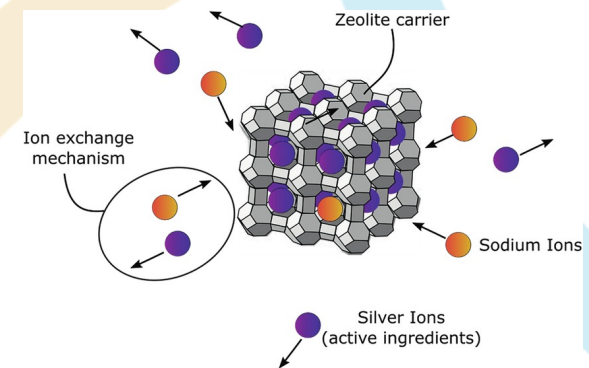
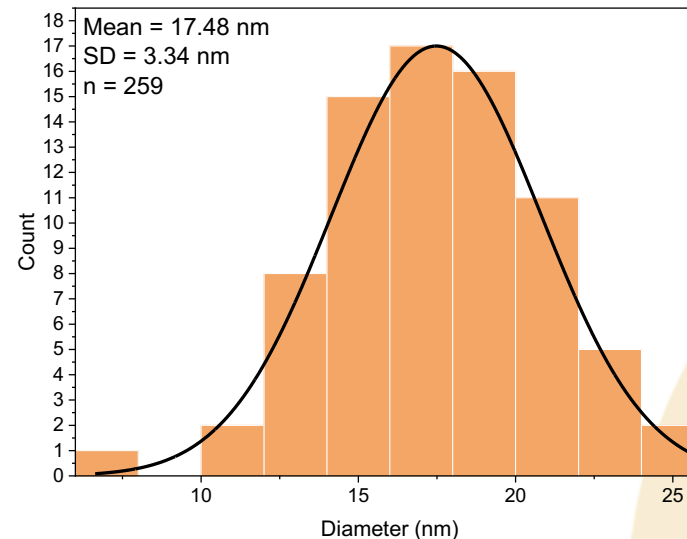
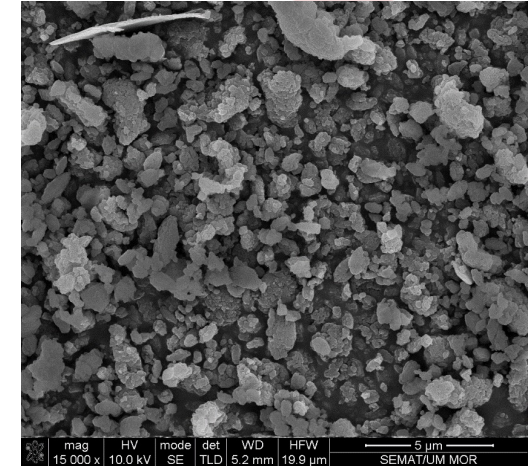
Alginate



Silver nanoparticles



Mordenite

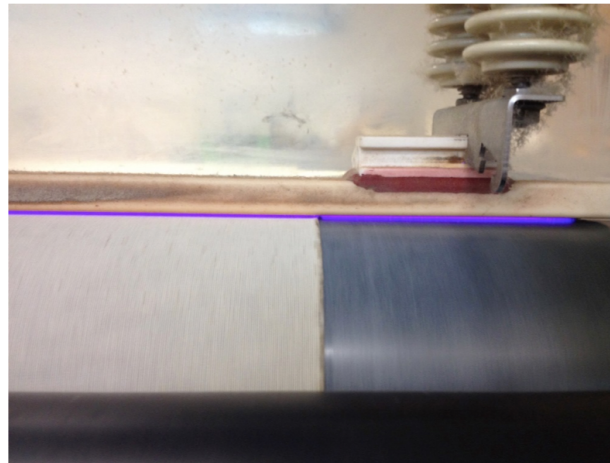
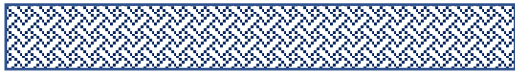


<https://www.chemistryworld.com/podcasts/sodium-alginate/7756.article>

Multi-component wound dressing

Dielectric barrier
discharge plasma

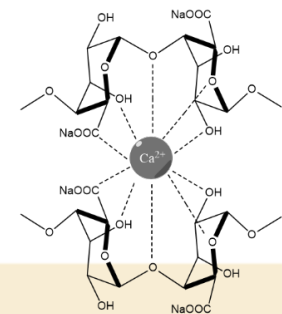
Polyester



Previous suspension

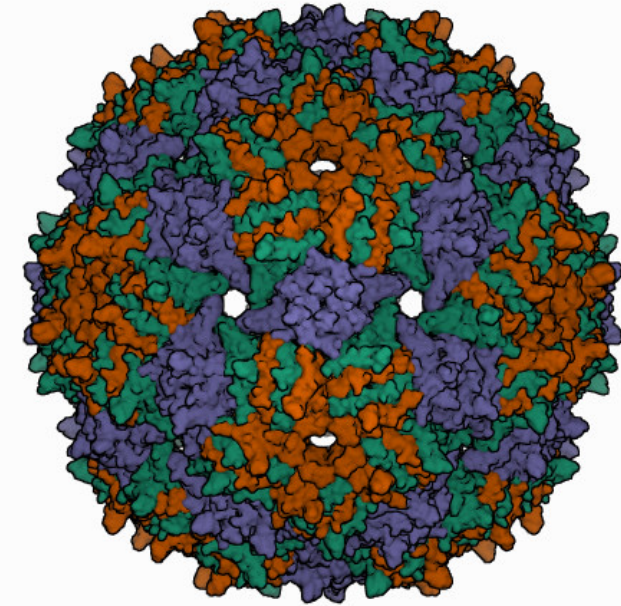
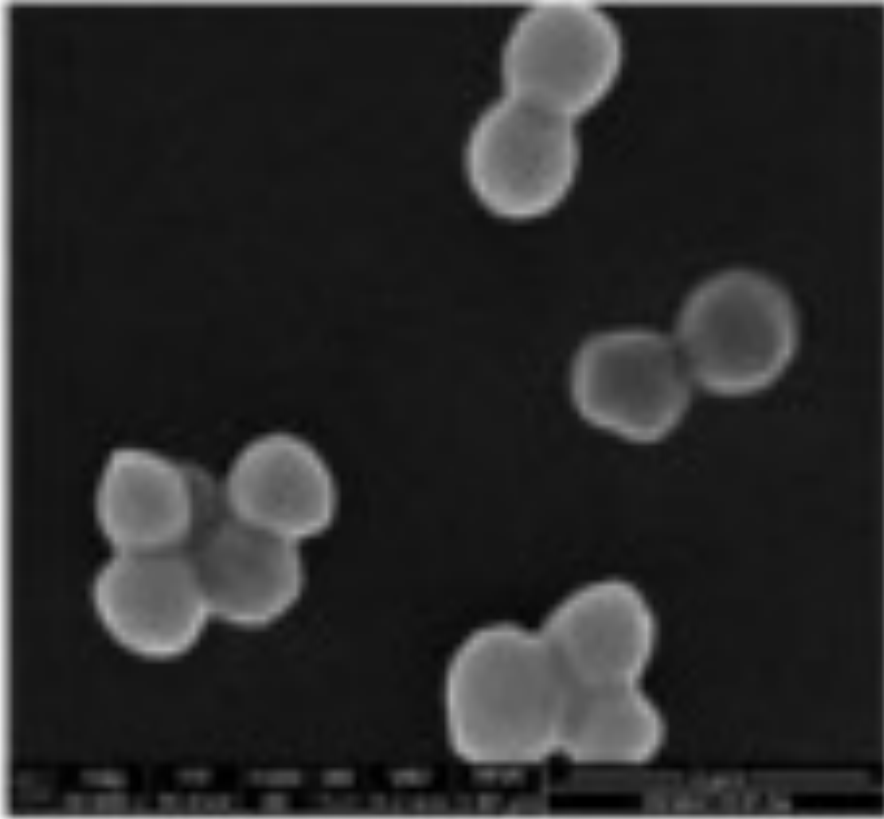


Padder



Crosslinked Alginate

Microorganisms



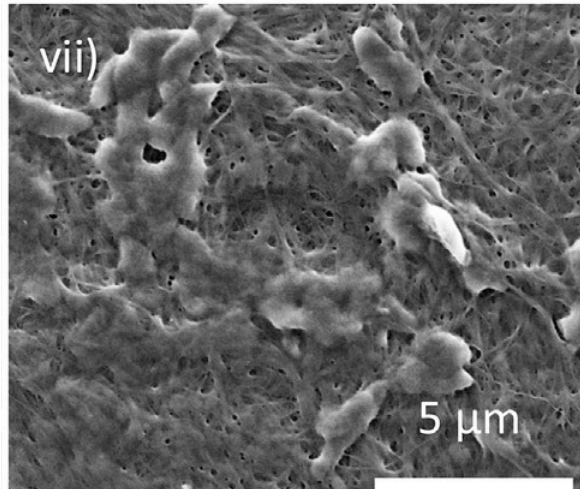
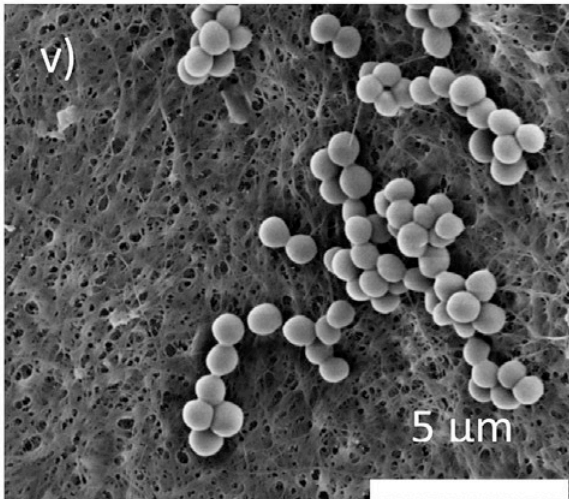
Protein data bank

Tavares T, Antunes J C, Padrão J, Ribeiro A I, Zille A, Amorim, M T P, Ferreira F, Felgueiras H P Activity of Specialized Biomolecules against Gram-Positive and Gram-Negative Bacteria, Antibiotics 2020

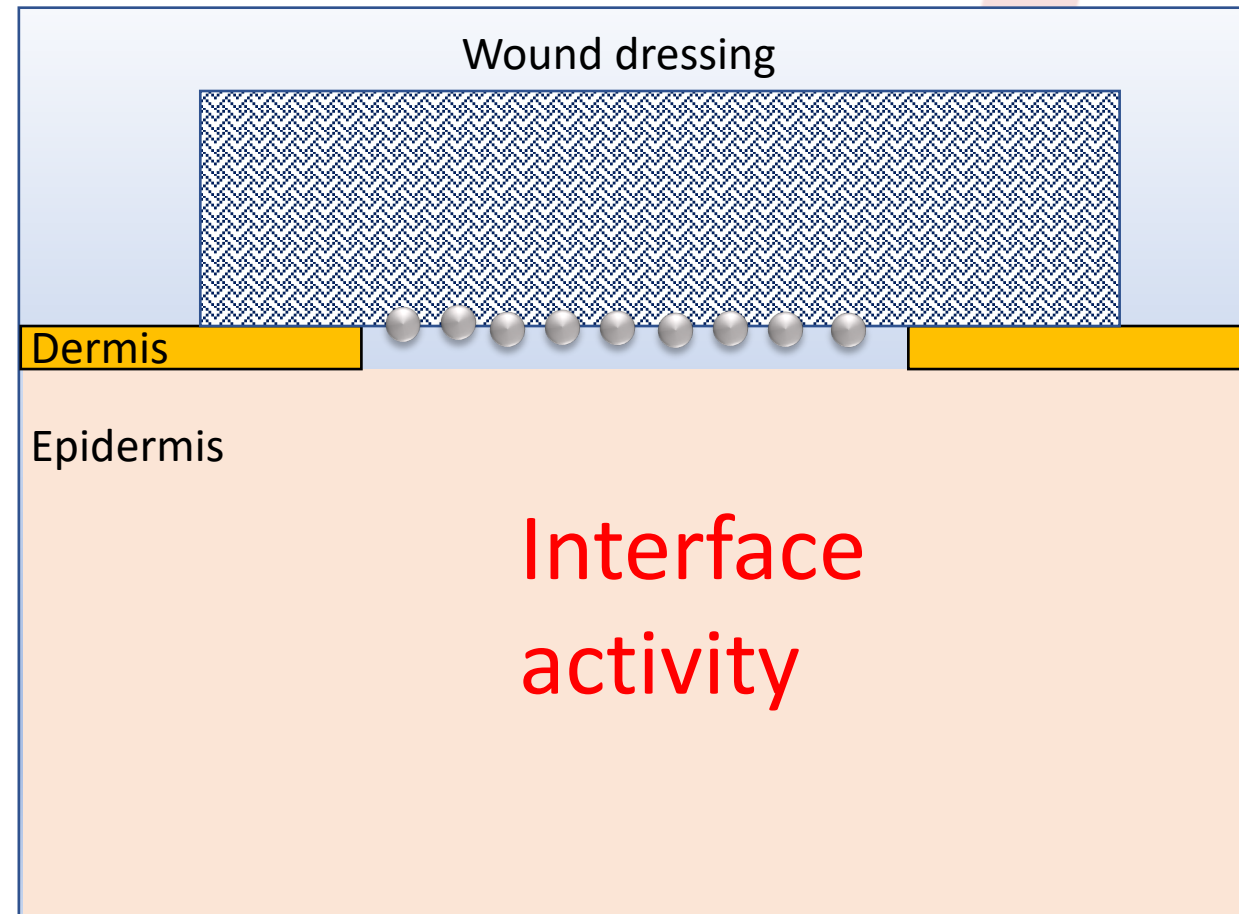
Antimicrobial methods

“Contact killing”

AATCC 100-TM100



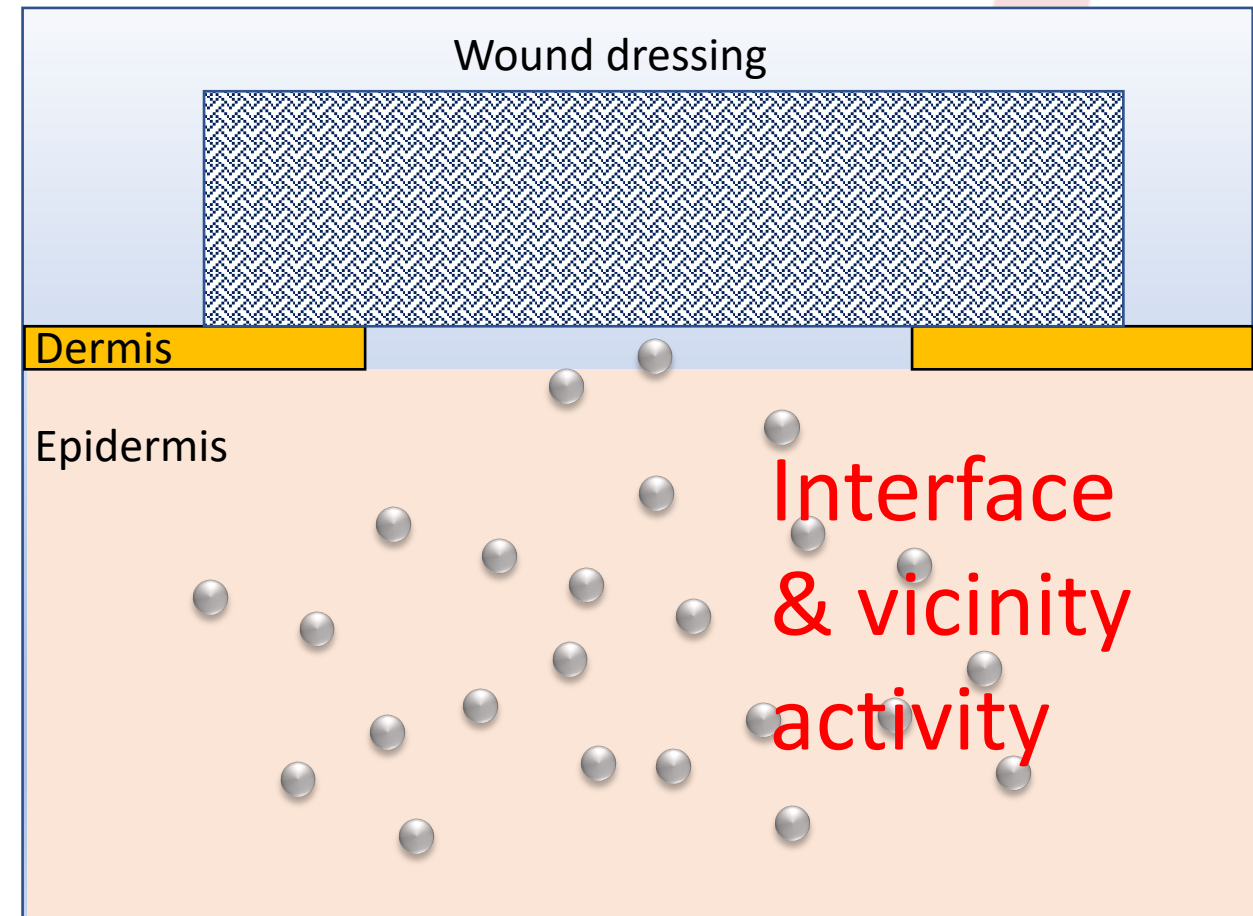
Padrão J, Gonçalves S, Silva J P, Sencadas V, Lanceros-Mendez S, Pinheiro A C, Vicente A A, Rodrigues L R, Dourado F, Bacterial cellulose-lactoferrin as an antimicrobial edible packaging, Food Hydrocolloids, 2016



Antimicrobial methods

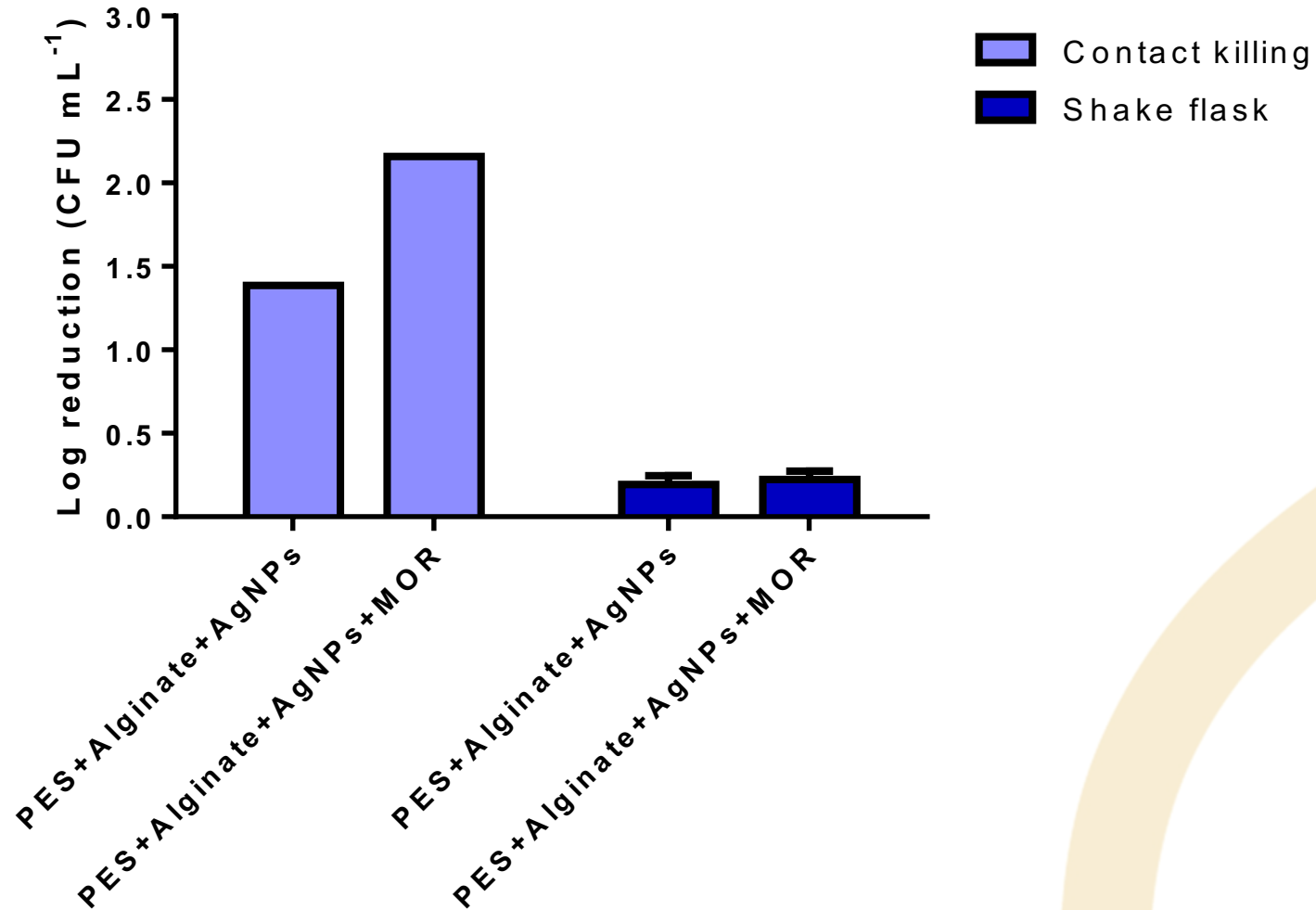
“Shake flask”

ASTM-E2149-01



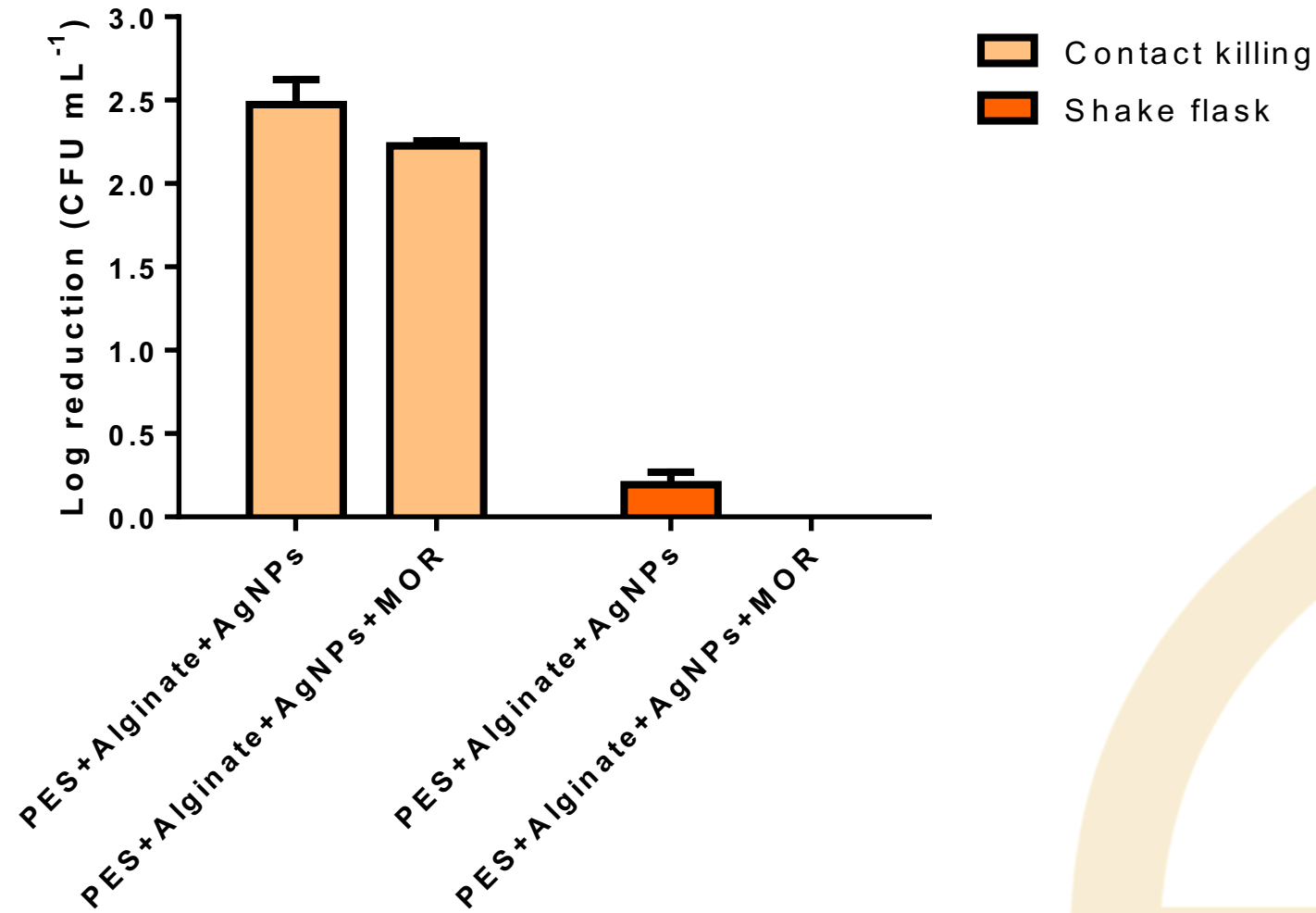
Staphylococcus aureus

a)

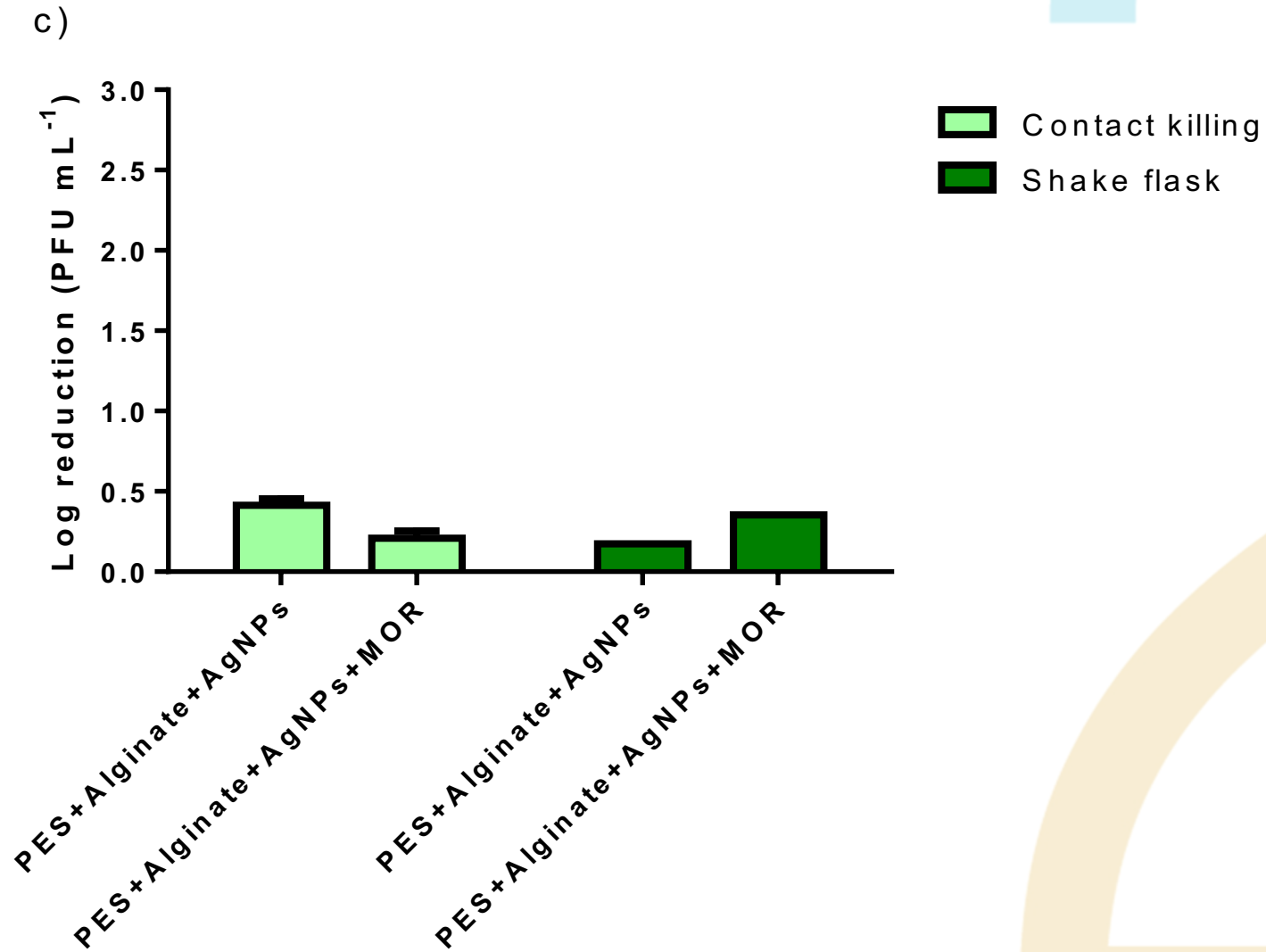


Escherichia coli

b)



MS2 bacteriophage



Concluding remarks

- Antimicrobial assays may be valid to assess immobilization
- Mild antibacterial activity, nevertheless potentiated by Mordenite
- No antiviral activity was detected (problem already solved)

Acknowledgements

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FCT

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Advances of Antimicrobial in Bioengineering

Guest Editors

Dr. Jorge Padrão, Dr. Andrea Zille, Dr. Helena P. Felgueiras, Dr. Joana C. Antunes

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